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Sagamore Hill Radio Observatory
Air Force Geophysics Laboratory
Hanscom Air Force Base, Massachusetts 01731

I. INTRODUCTION

During 1981, the remaining members of AFGL's Solar Radio Astronomy Section were consolidated with the energetic particles task at the laboratory. An emphasis of the combined group under the general direction of Ms. M. A. Shea is to understand particle acceleration mechanisms in solar flares as inferred from flare electromagnetic (including radio) and particulate emissions. As before, research efforts are applied to Air Force requirements in the radio propagation area, in particular, the forecasting of solar-induced disruptive effects on communications and surveillance systems.

Operational responsibility for the Sagamore Hill Radio Observatory rests with the Military Airlift Command's Air Weather Service (AWS). The solar radio patrol is carried out by AWS personnel especially trained as Astrogeophysical Data Analysts. This work is under the direction of Capt. Edward J. Eadon, Commander of Detachment 2, Third Weather Wing. Responsibility for routine maintenance for the solar-patrol equipment rests with the Air Force Communications Command (AFCC).

Because of the AFGL reorganization, this will be the last observatory report to which AFGL contributes. It is anticipated that in subsequent years joint observatory reports will be submitted by the AWS's Radio Solar Telescope Network (RSTN) observatories. Physical proximity, history, and shared interests, however, dictate that the special relationship between the solar researchers at AFGL and the observing staff at Sagamore Hill will continue to exist, if on a somewhat less formal basis.

II. SOLAR INSTRUMENTATION

Whole-Sun radio patrols are carried out from sunrise to sunset at nine fixed frequencies: 245, 410, 610, 1415, 2695, 4995, 8800, 15 400, and 35 000 MHz. The beamwidths of the fixed-frequency observations are at least several times the Sun's angular diameter to ensure nearly constant antenna response across the solar disk. In addition, a 25–75-MHz sweep-frequency system using a two-element interferometer qualitatively monitors solar meter/decameter burst activity. The coordinates of the solar site at Sagamore Hill (Hamilton, Massachusetts) are 42°37'54" N latitude, 70°49'15" W longitude.

During sunspot cycle 20, the Solar Radio Astronomy Section of AFGL was pleased to supply monthly compilations of quiet-Sun flux density and radio-burst summary data (at various patrol frequencies based on Sagamore Hill observations) to other observatories and researchers in the solar-terrestrial and space sciences. In turn, we have received similar data compilations from other observatories around the world. These compilations have greatly aided our research, and we hope to continue to receive these valuable data. Unfortunately, however, we have reached a manpower level that has significantly delayed our output of these data. The compilation for the year 1979 is now nearly complete and the AWS personnel at Sagamore Hill are continuing work on the report for 1980. Compilations will not be published by AFGL for the years after 1980. The Sagamore Hill burst and quiet-Sun data will continue to be published in *Solar Geophysical Data*.

The solar group at AFGL will retain the analog chart records (pen recordings of flux density versus time at several amplitude levels for the various patrol frequencies) of the Sagamore Hill solar patrol. The data base is fairly complete from 1966 to the present, with the possible exception of some early-year (1966–1968) records. Requests for copies of limited periods of analog chart records from universities or scientific groups will be fulfilled. In the case of requirements for extended periods of data, the Sagamore Hill records will be made available, and any interested organization may come and copy the records themselves. Beginning in November 1981, Sagamore Hill patrol data will no longer be kept on strip charts but will be stored solely on magnetic tape. These tapes will be sent to the World Data Center A for Solar-Terrestrial Physics in Boulder and all requests for *data taken after this date should be directed to Mr. Ronald* W. Buhmann, NOAA/EDIS (D63), 325 Broadway, Boulder, Colorado 80303.

A major effort of AFGL personnel of the Sagamore Hill Radio Observatory has been to provide technical support and guidance to the Electronic Systems Division (ESD) for the procurement and installation of the worldwide radio-observation network that will provide dedicated continuous monitoring of the whole Sun over a wide range of frequencies. The network, called RSTN (Radio Solar Telescope Network), will consist of three overseas stations (at Palehua, Hawaii; Learmonth, Australia; and a Middle East site yet to be determined) and the Sagamore Hill station. The overseas stations will be equipped with Air Force Logistics Command supportable hardware functionally similar to the instrumentation of the Sagamore Hill Radio Observatory. The overseas RSTN stations will be co-located with the stations of the Solar Observing Optical Network (SOON).

During the past year, the Sagamore Hill solar station has undergone major equipment changes. A significant upgrade occurred in September 1981 when the HP-1000 Model 45 computer system arrived as part of the continuing effort to make the Sagamore Hill instrumentation compatible to that at the other RSTN observatories. AFCC and AFGL personnel assisted with the installation of this computer system, which became operational in early October. Captain Tom Clark of Palehua Observatory installed the software to ensure that data acquisition at Sagamore Hill is nearly identical to that at the other RSTN observatories. Because the automated system requires fewer observers, Sagamore

Hill was able to return it to its normal sunrise-to-sunset duty schedule in December 1981. An observer shortage had resulted in reduced patrol hours from March through November.

In an additional equipment change, Dr. Donald A. Guidice and Mr. Carl P. Ferioli oversaw the dismantling of the west-side 28-ft antenna (following the transfer of the 610- and 1415-MHz patrols to other antennas). The dismantled 28-ft antenna was placed in the Air Force supply system to serve as a spare for all the RSTN observatories. Mr. Ferioli also refurbished the mount for the 3- and 1¼-ft antennas (15.4- and 35-GHz systems).

Recalibration of the absolute solar flux density at the various RSTN patrol frequencies continues. Capt. Eadon and Dr. Guidice successfully completed the calibration at 8800 MHz using the Moon as a reference source, but attempts at 4995 MHz were unsuccessful because of the lack of radiometer sensitivity and the weak radio emission of the Moon at that frequency. In 1982, the 2695-MHz system will be recalibrated using the Ottawa patrol as a standard, and the calibration at 4995 MHz will be checked by an interpolation between the revised quiet-Sun flux density values at 2695 and 8800 MHz.

III. SOLAR RESEARCH

The following papers and technical reports have been published (or submitted for publication) by the solar radio group at AFGL since the last observatory report:

Cliver, E. W. (1981). "Comments on the duration–peak-flux density diagram for 2800 MHz solar bursts," J. R. Astron. Soc. Can. 75, 15.

Cliver, E. W. (1982). "Prompt injection of relativistic protons from the September 01, 1971 solar flare," Sol. Phys. 75,341.

Cliver, E. W., Kahler, S. W. Shea, M. A., and Smart, D. F. (1981)."Onset delay times of ground-level events,"In *17th International Cosmic Ray Conference*, Paris, Vol. 9 (in press).

Kahler, S. W. (1982). "The role of the big flare syndrome in correlations of solar energetic proton fluxes and associated microwave burst parameters," (J. Geophys. Res. (in press).

Kahler, S. W. (1982). "Radio characteristics of solar proton flares," submitted to Astrophys. J.

Cliver, E. W., Kahler, S. W., Shea, M. A., and Smart, D. F. (1982). "Injection onsets of ~2 GeV protons, ~1 MeV electrons, and ~100 KeV electrons in solar cosmic ray flares," Astrophys. J.(in press).

Guidice, D. A., and Ferioli, C. P. (1981). "Improved 35 GHz radiometer for solar burst measurements," AFGL-TR-81-0253.

In addition, contractual efforts under the administration of the solar group are being conducted by Tufts University (high-resolution active-region mapping using the Very Large Array), the California Institute of Technology (search for flare precursors using radio polarized interferometer data), and the University of California (comparison of microwave and hard x-ray emissions from flares).

IV. PERSONNEL

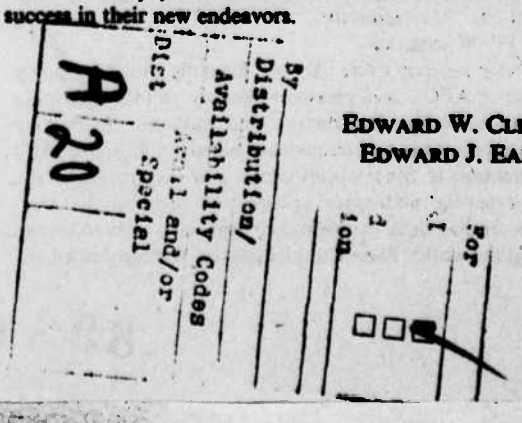
The observing staff at Sagamore Hill, under the direction of Capt. Eadon, consists of Master Sgt. Finley Dula (Chief Observer), Tech. Sgt. Richard Rickard, Tech. Sgt. Lawrence Lebsack, Staff Sgt. Steven Garrett, and Staff Sgt. David Cort.

Members of the energetic particles task at AFGL with research interests in solar physics include Ms. M. A. Shea (task leader), Mr. Don F. Smart, Mr. William R. Barron, and Mr. Edward W. Cliver. Over the summer months of 1981 we were ably assisted by three student physical science aids: Mr. Joseph P. Cronin, Ms. Judy M. Fink, and Ms. Stacy A. Horning. In addition, the group enjoys the full-time computer programming support of Ms. Louise C. Gentile of Emmanuel College.

Dr. Stephen W. Kahler was a welcome addition to our group during his 12-month stay at AFGL as a National Research Council Associate. Dr. Kahler returned to his previous position with American Science and Engineering in October.

Two long-time members of the Solar Radio Astronomy Section at AFGL were reassigned to new jobs and responsibilities in the Plasmas, Particles and Fields Branch in 1981. Mr. Carl P. Ferioli, who has been with the group since its inception, built solar radio monitoring instrumentation at Athens and Manila observatories as well as Sagamore Hill over the course of his career and directed the installation of the RSTN systems at Palehua and Learmonth. Since Dr. Donald A. Guidice joined the group in 1969, he has been involved with all facets of our group's activity including equipment development, solar research, and administration and management. His accomplishments include developing the 5-GHz polarization system and the improved-sensitivity 35-GHz radiometer, making theoretical contributions to the understanding of absorption mechanisms in solar microwave bursts, and providing technical direction to the Electronics System Division in the specification, acquisition, and acceptance testing of the RSTN system. For the past three years, Dr. Guidice has served as the Chief of the Solar Radio Astronomy Section. We thank Dr. Guidice and Mr. Ferioli for their many years of dedicated service and wish them success in their new endeavors.

EDWARD W. CLIVER
EDWARD J. EADON



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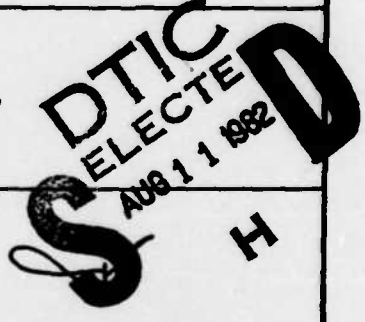

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Sagamore Hill
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The present relationship of AFGL/PHG personnel to the AWS unit at Sagamore Hill is defined. The current status of the Radio Solar Telescope Network (RSTN) is reviewed. Equipment changes at Sagamore Hill during 1981 are summarized. Publications by solar radio section personnel during 1981 are listed.

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